Walking the Tightrope on Medicare Reform

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David M. Cutler

The most striking feature of the current debate over Medicare reform is the disagreement about even the basic goals of reform. Medicare is a major fiscal responsibility and has increased in cost far more rapidly than the average rate of growth of the economy. Medicare is currently 2.5 percent of GDP ($5,500 per beneficiary) and is expected to more than double in the next half century, even under very conservative assumptions. Some people, therefore, argue that the primary goal of Medicare reform is to slow the growth rate of the program. But Medicare also has very limited benefits. It does not cover outpatient prescription drugs or a significant part of long-term care expenses. Lack of complete coverage may have important effects on the health of the elderly. Others, therefore, argue that Medicare reform should concentrate primarily on enhancing the program's generosity.

The conflict between the need for contraction and the desire for expansion has played out repeatedly in the past few years. President Clinton's health reform plan in 1993-94 proposed reducing "wasteful" Medicare and private insurance spending to finance expanded benefits and health insurance coverage for the uninsured (Cutler, 1994). People agreed uniformly there was waste in the system but the plan was still defeated, in part because of concerns that the plan had no way to separate out valuable from wasteful services. The Republicans in 1995 proposed reducing the growth in future Medicare expenses to finance deficit reduction and tax cuts. Concern was again raised about rationing, however, and the plan met with the same fate.

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Reconciling the difference between the contraction and expansion views of Medicare is essential to breaking the logjam over fundamental Medicare reform. At heart, these views embody different beliefs about the return to Medicare spending—does Medicare provide a high or low return?

I argue in this paper that the contraction and expansion views are both correct; Medicare is wasteful in some areas but not large enough in others. On average, Medicare spending is quite valuable. When looking across long periods of time, the increase in Medicare spending is almost certainly worth the money spent. Going forward, therefore, efforts to restrict the long-term growth of Medicare would be welfare-reducing. At the margin, however, there is substantial misallocation of resources. Many services that are provided are not worth their cost, and many services that are valuable are not provided. Reform could significantly improve health at no cost, or even a cost savings.

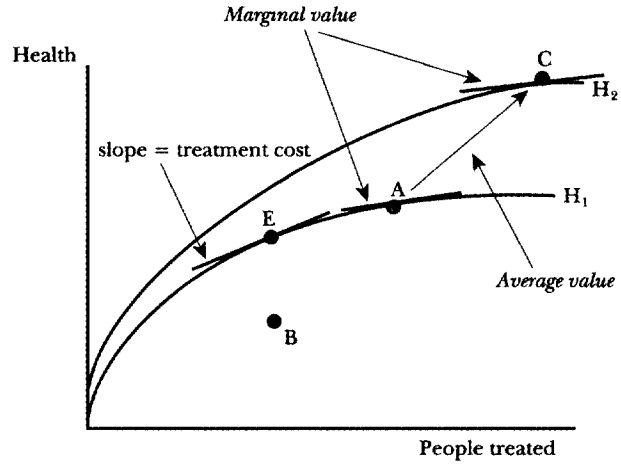
The challenge for Medicare reform is to walk the tightrope between valuable spending increases, which will take advantage of long-run technological progress to improve health—and the appropriate allocation of resources given what is available. However, designing reforms to meet both goals will be very difficult. In practice, many reforms shift the allocation of existing costs more than they rationalize the delivery of services. Such reforms ignore the central question of appropriate resource allocation in Medicare.

Evaluating the Worth of Medicare

Measuring the value of Medicare requires determining the health improvement that results from it. Consider a simple case of one treatment for a particular condition. Imagine ranking people by how much they would benefit from receiving the treatment. Curve H_1 in Figure 1 shows the health possibility frontier, measured in dollar value of benefits, associated with differing numbers of people receiving the treatment. The curve is upward-sloping and flattens out as more people are treated, reflecting the positive but diminishing marginal value of care.

The optimal point for society is at point E, where the slope of the health possibility frontier is equal to the cost of the treatment. Everyone to the left of E receives value greater than cost, and everyone to the right receives value less than cost. There are two types of suboptimal equilibria worth remarking. First, too many people could receive the treatment. Since patients pay little for medical care at the margin and providers have historically been reimbursed on a fee-for-service (or piece-rate) basis, one might expect service provision to continue to the point where the marginal value of medical services is near zero. Such a situation is shown as point A. Second, the wrong people may be receiving the treatment. If people with lower value are receiving the treatment but people with higher value are not, one might wind up at point B. Point B might result because private demands do not necessarily reflect social valuation. In the case of Medicare, even though insurance coverage is generally similar for all Medicare beneficiaries, access to particular

Figure 1
The Average and Marginal Values of Medical Care



providers may differ by area, socioeconomic status, or other factors which will favor some beneficiaries at the expense of others.

Now consider an expansion in technological capability over time. Perhaps physicians get better at the same treatments (for example, through learning by doing) or new treatments are developed. As Newhouse (1992) notes, technological change has been a ubiquitous feature of medical systems in developed countries over the past half century and is responsible for most of the cost increases over time. The technological improvement would shift out the health possibility frontier in Figure 1 to H_2; a greater level of health could be achieved for the same resource input. Point C is the point on H_2 with the same marginal value of medical treatment as point A.

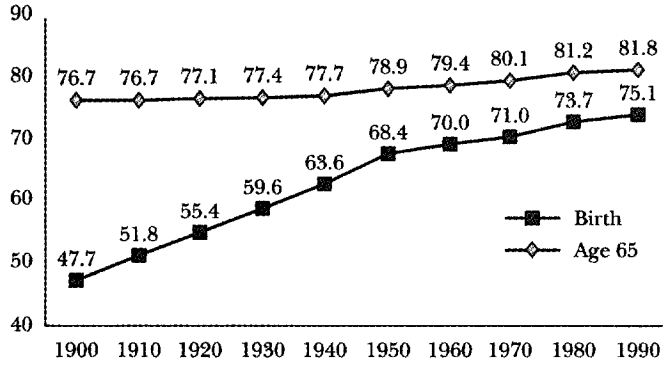
The average value of medical technology changes is the slope of the line from A to C. Medical spending is worth it on average if this slope is greater than the cost of the additional resources. The marginal value of medical care is the slope of the health possibility frontier at any point. By definition, the marginal value of medical care is the same at points A and C.

There is no necessary relation between the average and marginal values of health care, nor between the average value and the degree of misallocation. In Figure 1, moving from A to C has very high average value, but the marginal value is low at both points. If one were at point B to begin with, one could observe a high average value of technological change but still find substantial misallocation. In evaluating Medicare, therefore, it is important to consider each of these different margins.

The Average Value of Care: The Benefits of Innovation

Measuring the average value of Medicare requires valuing the health of the population over time. Health involves both mortality and morbidity; since mortality

Figure 2
Life Expectancy at Birth and Age 65



Source: Social Security Administration (1992).

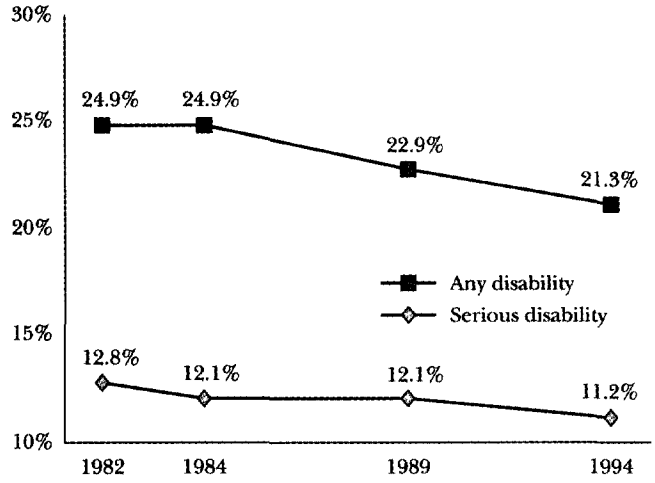
is easiest to measure, I start with that. Figure 2 shows life expectancy at birth and the expected age of death at age 65 over the 20th century. Medicare was passed into law in 1965 and began operation the next year, but the longer time period sets the context for evaluating the Medicare era. Life expectancy at birth has increased by 27 years since 1900, and life expectancy at age 65 has increased by 5 years.

However, the nature of longevity improvements has changed over time. Between 1900 and 1940, life expectancy at birth increased by over 15 years, while life expectancy at age 65 increased by only 1 year. Only 7 percent of increased life expectancy at birth was because of mortality reductions past age 65. Public health improvements such as pasteurized milk and cleaner streets (Preston, 1996) and increased nutrition (Fogel, 1994) concentrated mortality gains at young ages.

In the next two decades, the dominant contributor to mortality reduction was the discovery of antibiotics—penicillin and sulfa drugs in particular. Since infectious diseases killed both young and old, mortality rates fell at all ages. Life expectancy increased by 1.7 years at age 65 and 6.4 years at birth.

In the post-1960 era, life expectancy improvements have increasingly tilted towards the elderly. Life expectancy at age 65 rose by 2.4 years between 1960 and 1990, compared to a rise of 5.1 years at birth. In other words, close to half of increased life expectancy for infants in this time period was a result of longer expected survival when elderly. The nature of the mortality improvements highlights the role of medical care in this advance. The dominant source of mortality reduction in the post-1960 period is reduced mortality from cardiovascular disease; cardiovascular disease mortality fell by nearly two-thirds between 1960 and 1990. Better cardiovascular disease health results from three factors: people engaging in fewer risky habits such as smoking; improved management of less severe coronary artery disease (for example, better control of hypertension); and better treatment of acute events such as a heart attack (Cutler and Kadiyala, 1999). To differing degrees, all of these factors are a function of medical care.

Figure 3
Disability Among the Elderly, 1982–94



Source: Manton et al. (1997).

In addition to declining mortality, morbidity has fallen in recent decades as well. Figure 3 shows the share of the elderly reporting various degrees of functional disability in the 1980s and 1990s (Manton et al., 1997). Disability is defined alternately as at least one impairment in physical activities of daily living, or as a less severe measure that also includes impairments in social tasks indicating one's ability to care for oneself.[1] Both measures of morbidity show an improvement in health over time. Between 1982 and 1994, disability rates fell by between 1 and 1.5 percent per year. This continues a longer-term trend of better health dating from the turn of the century (Costa, 1998).

The improvement in health has a value to individuals. Specifying the exact value of better health is difficult, but the literature has estimates based on two types of studies: compensating differentials analyses, where actual individual tradeoffs between risky situations and money are used to infer the value of life, and contingent valuation studies, which use surveys to infer values. A rough consensus from this literature is that an additional year of life is worth about $100,000 per year (Viscusi, 1993; Tolley et al., 1994). The first columns of Table 1 summarize the value of additional longevity implied by these estimates. Between 1960 and 1990, life expectancy increased by 2.4 years, for a rough value of $240,000 per person.

This calculation omits benefits from reduced morbidity. However, other work

[1] More specifically, "Activities of Daily Living" or ADLs include eating, getting in and out of bed, mobility, dressing, bathing, and using the toilet. "Instrumental Activities of Daily Living," or IADLs, include heavy housework, light housework, laundry, meals, shopping, getting around outside, and managing money.

Table 1
Expected Medicare Spending and Health for New Medicare Eligibles

	Value of Life		*Spending*	
Year Reaching Age 65	*Length of Life*	*Change in Value*	*Medicare Spending*	*Change in Spending*
1960	14.4	—	$ 0	—
1970	15.1	$ 70,000	15,500	$15,500
1980	16.2	110,000	32,000	16,500
1990	16.8	60,000	56,500	24,500
Change, 1960–90	—	$240,000	—	$56,500

Note: Spending data are for 1967, 1977, and 1987. Value of a life–year is assumed to be $100,000. See Cutler and Richardson (1999) for details.

I have done finds that including morbidity strengthens these conclusions (Cutler and Richardson, 1999). The gains from better health are large.

The value of lengthened life needs to be compared to the cost of extending life. The second columns of Table 1 show expected Medicare spending (in 1990 dollars) for a person reaching age 65 in the indicated year.[2] I report Medicare spending as zero in 1960, even though some public programs supported the elderly prior to Medicare. These programs were generally modest, however. By 1990, expected Medicare spending for a lifetime was over $55,000 per person. The projection for 2000 is about 50 percent higher than the 1990 figure.

The key issue for considering the average value of Medicare spending is to determine how important Medicare was for the improvement in health. If all of the health improvements resulted from Medicare, the program would clearly be worthwhile. If very little resulted from Medicare, the money would not be worth it.

Answering this question requires first understanding how Medicare affected medical spending of the elderly. If the elderly would have saved privately the amount they receive from Medicare and been able to purchase the Medicare package when elderly, Medicare would have no effect on medical spending, only on the distribution of income. In this scenario, one might expect very few health benefits from the creation of Medicare. The rapid growth of medical costs means that saving would likely have been inadequate, however, and private health insurance markets function poorly, so Medicare probably could not have been replicated privately. Thus, at least some, and perhaps most, of the health gains for the elderly are attributable to Medicare.

The data in Table 1 indicate that Medicare would need to account for

[2] I use 1990 dollars, assuming that $100,000 per year of life reflects estimates in that year. Generally, the value of a year of life is based on somewhat older data, which will bias the estimate of the value of additional life too low. For simplicity, both the costs and benefits of medical treatments are shown without discounting. Including a moderate discount rate for both values does not change the conclusions presented here (Cutler and Richardson, 1999).

24 percent ($56,500/$240,000) of the survival improvements since 1960 for the additional spending to be worth it. The epidemiological literature suggests quite strongly that medicine has contributed this amount. As noted above, the leading contributor to improved health in the post-1960 period was reduced cardiovascular disease mortality. Data from the Framingham Heart Study and other surveys generally show that medical care explains a significant part of this impact—either acute treatments after a serious incident or non-acute services on an outpatient basis (Goldman and Cook, 1984; Sytkowski, 1990; Hunink et al., 1997). The medical factors are generally new since 1960. Behavioral factors are also important, and even these changes owe some role to medical care—for example doctors who encouraged patients to stop smoking after the Surgeon General's first report on the health hazards of smoking in 1964. While the evidence is not definitive, it strongly suggests that the increase in Medicare spending was worth its cost. I thus conclude that the average benefit of Medicare spending is likely to be high.

If the returns to new medical technology continue to be high in the future, then from a social point of view, it is beneficial to have steadily rising levels of Medicare spending; conversely, if the rewards to future technology are likely to be relatively low, then it would make more sense for a Medicare reform strategy to focus on holding down costs. There is no way to know the impact of future technology for certain, but it seems more probable than not that it will continue to have a highly beneficial impact than the alternative scenario. The genetic revolution will identify genes that make people more or less likely to contract certain diseases, and will highlight the molecular and cellular components of life-threatening ailments such as cancer and heart disease. Therapies based on this knowledge may prevent these diseases or eradicate them before they do serious damage. Potential treatments may be fundamentally different from what is available today, in the same way that the polio vaccine is very different from the iron lung it replaced. The average return to such knowledge would indeed be high (Murphy and Topel, 1999).

Resource Allocation

In contrast to the high average return for Medicare, substantial evidence suggests that Medicare services are not allocated very efficiently. The marginal value of many services is low and many people go without valuable care.

There is much evidence that high-tech medical services are frequently overused. Medicare spending, for example, varies by a factor of two between different regions of the country, with the gap typically associated with differential use of very expensive procedures. But people appear no healthier in regions that spend more compared to regions that spend less (Skinner and Wennberg, 1999). International comparisons reach the same conclusion. Intensive medical services in the treatment of heart attacks, for example, are used perhaps five times more frequently in the United States than in Canada, but the preponderance of the evidence suggests

no difference in survival in the two countries (Mark et al., 1994; Rouleau et al., 1993; Tu et al., 1997).[3] As another example, patients who live closer to a high-tech hospital are more likely to receive high-tech care than are patients who live farther away from such a hospital, and yet outcomes for the two groups of patients are relatively similar (McClellan, McNeil and Newhouse, 1994). Finally, direct examinations comparing when treatments are provided with clinical guidelines for when they are appropriate indicate that up to one-third of the use of many common procedures is either inappropriate or of equivocal value (Chassin et al., 1987; Winslow et al., 1988a, 1988b; Greenspan et al., 1988).

In other circumstances, particularly outpatient use of prescription drugs, many people receive too little care. For example, less than half of patients who would benefit from beta blockers after a heart attack receive these drugs (Brand et al., 1995; Soumerai et al., 1997; Wang and Stafford, 1998), despite the fact that such drugs cut the mortality risk in half. Even in the face of widespread knowledge about the risks of high blood pressure, only half of people with hypertension are taking medication to control it. The share of hypertensives with successfully controlled blood pressure is only about one-quarter.

Why such a poor matching of patients to treatments? Such an outcome is consistent with the incentives in the Medicare system. Medicare payments to physicians are typically made on a fee-for-service, or piece-rate basis. When physicians do more, they are rewarded with increased revenues. Patients are also well-insured for most care. As a result, they demand care with any medical value. Thus, on both the demand and supply sides of the market, the incentives are to overconsume high-tech care.

Outpatient services are less well covered. Medicare does not cover outpatient prescription drugs, for example, partly explaining the underuse of these services. But lack of insurance is not the entire explanation. Even people with coverage for outpatient prescription drugs have low rates of pharmaceutical use in situations where they would be of great benefit (Wang and Stafford, 1998).

A deeper set of incentives appears to be at work, having to do with the structure of the medical system itself. Medicare, like the medical system as a whole, is focused on the treatment of disease, not the promotion of health. The medical system pays well for treating people with severe illnesses; these situations are thus handled moderately well. But the system does not encourage keeping people healthy. Indeed, reimbursement is lower when people are healthy than when they are sick, since they use fewer services. As a result, health promotion is not stressed.

Consider the treatment of cardiovascular disease. When an elderly person has a heart attack, a cardiologist becomes captain of the team. The cardiologist decides what tests the patient should receive, which therapies are appropriate, and who should provide them. In contrast, many of the elderly effectively act as their own internist for non-emergency services: they decide when to visit the cardiologist,

[3] There is some evidence that morbidity is lower in the United States, but quality of life has rarely been measured on a comparable basis in the two countries.

what medications to start and stop taking, and what tests they need. The elderly are not very good at being internists; rates of drug compliance and appropriate visits are low. A more effective medical care system would find ways to promote health, in addition to treating people when they are sick.

Allocating medical resources more appropriately would decrease medical costs in some areas and increase them in others. For example, inpatient costs might decline as care with little value was eliminated, while outpatient costs might increase as more people received valuable care. Although the net impact of such a shift on costs is uncertain, outcomes would certainly improve and the rate of return would be high.

Implications for Medicare Reform

The challenge for Medicare reform is to provide both more and less at the same time: more of the valuable technology and services that are currently lacking, and less of the wasteful services that are currently provided. Designing a system to balance such goals is difficult. It is relatively easy to make a medical system more or less generous as a whole, but reorienting some incentives one way and others a different way is more difficult. Ultimately, all of the common reform proposals have problems with this goal.

There are three classes of reform proposals. The first is to shift more of the costs of Medicare on to patients. For example, some have argued for increasing the cost sharing for Medicare services or increasing the premium required of beneficiaries to access the program. Others argue for forcing the young to save today and using the proceeds to finance Medicare in the future. Still others argue for increasing the age of eligibility for enrolling in Medicare.

Changing the financial structure of Medicare has many benefits. As the elderly have grown richer and the young less numerous, some steps along these lines seem natural. But shifting the financing alone does not address the efficiency problems. If all or some Medicare beneficiaries pay higher premiums but have the same level of insurance, they have no more incentive to cut back on excess utilization or get more appropriate care than they do today. Indeed, most of the elderly already have supplemental insurance to pay for the cost sharing required by Medicare. As a result, increasing Medicare cost sharing would lead to increased costs for supplemental insurance. But with the same overall level of insurance, there would be no incentive to alter the use of resources. As a result, these proposals for cost-shifting are not a complete solution to the Medicare problem.

A second set of proposals are those that seek to control Medicare costs by reducing provider payments. Hospital and physician fees might be cut below expected amounts, for example, and outpatient services could be paid less as well. As McClellan notes in his paper for this symposium, the Balanced Budget Act of 1997 made a number of significant changes along these lines, and Medicare growth has slowed substantially in the wake of that legislation.

But payment reductions also ignore the efficiency issues. Paying physicians less

will not encourage them to provide better outpatient care; if anything, outpatient care will suffer. Hospitals paid less might hold off on new technology acquisitions, which would be detrimental to the system over the long term. Payment reductions can control costs in the short term, when resources are fixed, as in the impact of the Balanced Budget Act of 1997 on Medicare spending. But Medicare reforms based on payment reductions face problems in the long run, when services are variable. In practice, payment reductions may have recently run their course. The Balanced Budget Act of 1997 reduced Medicare spending so substantially that Congress appropriated additional funds for providers in 1999.

A third set of reform proposals are those that create more choice among health insurance plans. Unlike the current Medicare system, where most people are in one fee-for-service plan, these proposals allow people to choose among competing insurers. The government would pay a fixed amount per enrollee and people would use that amount, and any additional amount required, to enroll in the plan of their choice. The hope is that price competition will induce insurers to monitor excessive utilization and promote healthy behavior. Further, competition would provide a gauge for which new technologies consumers valued. Variations on choice-based proposals have been made recently by the Bipartisan Commission on Medicare Reform and the Clinton administration. These proposals differ in important ways, but the goals are similar.

The central difficulty for such proposals is adverse selection (Rothschild and Stiglitz, 1976; Cutler and Zeckhauser, 2000). In a choice-based Medicare system, individuals will have to pay more for choosing a more generous plan—for example, a fee-for-service plan with fewer restrictions on provider choice in comparison to an HMO. Since less healthy people value additional benefits more than healthier people, the most generous plans will attract a less healthy mix of enrollees. This, in turn, will drive up their relative costs above the amount that benefit differences alone would dictate. Such adverse selection has several important consequences for Medicare. First, it will lead people to enroll in the wrong plans. Some people who value more generous plans at above their actuarial cost will still enroll in less generous plans, because the premium differences between the two plans will be greater than the difference in actuarial value. In effect, adverse selection gives people a subsidy to choose less generous insurance. Enrollment distortions resulting from adverse selection are large in practice (Cutler and Reber, 1998). Second, adverse selection encourages plans to avoid high-tech services that attract sick people. Providing the latest oncology treatment, for example, may lose money if it attracts people with a family history of cancer. This is true even if the specific oncology treatment makes sense in cost-benefit terms, since the question for the health care provider is not whether the individual treatment makes economic sense, but rather whether attracting a disproportionately large number of cancer patients makes economic sense. Evidence from the private sector transition to managed care tentatively suggests that competition does reduce the rate of technological diffusion (Cutler and Sheiner, 1998; Baker and Spetz, 1999).

Choice-based systems need some way to overcome the adverse selection prob-

lem or they may do more harm than good. The most promising approaches are "risk-adjustment" strategies that pay more for plans that enroll sick people. These payments would reduce or eliminate the adverse consequences of attracting the less healthy. Common approaches pay more for people based on their diagnosis or pool very high cost cases through a reinsurance mechanism. Indeed, risk-adjustment could be coupled with bonus payments for plans that provide appropriate outpatient care, to promote increased use of these services. Medicare and private insurers are beginning to experiment with risk-adjustment systems, and progress on this issue promises to come soon.

All three strategies for Medicare reform raise concerns. In the world of health care, where problems of making second-best choices are endemic, this is no surprise. But the problem for Medicare is particularly difficult because of the multiple, conflicting goals—the need to encourage both more and less at the same time. The ability of America's political system to balance such divergent interests will have a major impact on Medicare, and the American medical care system, for decades to come.

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References

Baker, Laurence and Joanne Spetz. 1999. "Managed Care and Medical Technology Growth." NBER Working Paper No. 6894, January.

Brand, D.A., L.N. Newcomer, A. Freiburger and H. Tian. 1995. "Cardiologists' Practices Compared with Practice Guidelines: Use of Beta-Blockade After Acute Myocardial Infarction." *Journal of the American College of Cardiology.* November 15, 26:6, pp. 1432–1436.

Chassin, Mark et al. 1987. "Does Inappropriate Use Explain Geographic Variations in the Use of Health Care Services?" *Journal of the American Medical Association.* November 13, 258:18, pp. 2533–2537.

Costa, Dora. 1998. "Understanding the Twentieth Century Decline in Chronic Conditions Among Older Men." NBER Working Paper No. 6859, December.

Cutler, David M. 1994. "A Guide to Health Care Reform." *Journal of Economic Perspectives.* Summer, 8:3, pp. 3–29.

Cutler, David M. and Srikanth Kadiyala. 1999. "The Economics of Better Health: The Case of Cardiovascular Disease," mimeo.

Cutler, David M. and Ellen Meara. 2000, forthcoming. "The Technology of Birth: Is it Worth It?" *Frontiers in Health Policy Research, Volume III.* Alan Garber, ed. Cambridge, MA: MIT Press.

Cutler, David M. and Sarah Reber. 1998. "Paying for Health Insurance: The Tradeoff Between Competition and Adverse Selection." *Quarterly Journal of Economics.* May, 113:2, pp. 433–66.

Cutler, David M. and Elizabeth Richardson. 1999. "Your Money and Your Life: The Value of Health and What Affects It," in *Frontiers in Health Policy Research, Volume II.* Alan Garber, ed. Cambridge, MA: MIT Press, pp. 99–132.

Cutler, David M. and Louise Sheiner. 1998. "Managed Care and the Growth of Medical Expenditures," in *Frontiers in Health Policy Research, Volume I.* Alan Garber, ed. Cambridge, MA: MIT Press, pp. 77–115.

Cutler, David M. and Richard Zeckhauser. 1999. "The Anatomy of Health Insurance."

NBER Working Paper No. 7176. Forthcoming in *Handbook of Health Economics*. Joseph Newhouse and Tony Culyer, eds.

Fogel, Robert W. 1994. "Economic Growth, Population Theory, and Physiology: The Bearing of Long-Term Processes on the Making of Economic Policy." *American Economic Review*. June, 84:3, pp. 369–95.

Goldman, Lee and E. Fran Cook. 1984. "The Decline in Ischemic Heart Disease Mortality Rates: An Analysis of the Comparative Effects of Medical Interventions and Changes in Lifestyle." *Annals of Internal Medicine*. December, 101:6, pp. 825–36.

Greenspan, Allan M. et al. 1988. "Incidence of Unwarranted Implantation of Permanent Cardiac Pacemakers in a Large Medical Population." *New England Journal of Medicine*. January 21, 318:3, pp. 158–63.

Hunink, Maria G. M., Lee Goldman, Anna N. A. Tosteson, Murray A. Mittleman, Paula A. Goldman, Lawrence W. Williams, Joel Tsevat and Milton C. Weinstein. 1997. "The Recent Decline in Mortality From Coronary Heart Disease, 1980–1990." *Journal of the American Medical Association*. February 19, 277:7, pp. 535–42.

Manton, Kenneth G., Larry Corder and Eric Stallard. 1997. "Chronic Disability Trends in Elderly United States Populations: 1982–94." *Proceedings of the National Academy of Sciences*. March 18, 94:6, pp. 2593–2598.

Mark, Daniel B. et al. 1994. "Use of Medical Resources and Quality of Life After Acute Myocardial Infarction in Canada and the United States." *New England Journal of Medicine*. October 27, 331:17, pp. 1130–1135.

McClellan, Mark, Barbara McNeil and Joseph P. Newhouse. 1994. "Does More Intensive Treatment of Acute Myocardial Infarction In the Elderly Reduce Mortality?: Analysis Using Instrumental Variables." *Journal of the American Medical Association*. September 21, 272:11, pp. 859–66.

Murphy, Kevin M. and Robert H. Topel. 1999. "The Economic Value of Medical Research." University of Chicago, mimeo.

Newhouse, Joseph P. 1992. "Medical Care Costs: How Much Welfare Loss?" *Journal of Economic Perspectives*. Summer, 6:3, pp. 13–29.

Preston, Sam. 1996. "American Longevity: Past, Present, and Future." Syracuse University Policy Brief No. 7/1996. Distinguished Lecturer in Aging Series, Center for Economic Policy Research Policy Brief.

Rothschild, Michael and Joseph E. Stiglitz. 1976. "Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information." *Quarterly Journal of Economics*. November, 90:4, pp. 629–49.

Rouleau, Jean L. et al. 1993. "A Comparison of Management Patterns After Acute Myocardial Infarction in Canada and the United States." *New England Journal of Medicine*. March 18, 328: 11, pp. 779–84.

Skinner, Jonathan and Jack Wennberg. 1999. "How Much is Enough? Efficiency and Medicare Spending in the Last Six Months of Life," in *The Changing Hospital Industry*. David Cutler, ed. Chicago: University of Chicago Press, pp. 169–93.

Social Security Administration. 1992. *Life Tables for the United States Social Security Area: 1900–2080*. Actuarial Study No. 107, August, Washington, D.C.

Soumerai, Stephen B., Thomas J. McLaughlin, Donna Spiegelman, Ellen Hertzmark, George Thibault and Lee Goldman. 1997. "Adverse Outcomes of Underuse of Beta-Blockers in Elderly Survivors of Acute Myocardial Infarction." *Journal of the American Medical Association*. January 8, 277:2, pp. 115–21.

Sytkowski, Pamela A. et al. 1990. "Changes in Risk Factors and the Decline in Mortality from Cardiovascular Disease." *New England Journal of Medicine*. June 7, 322:23, pp. 1635–1641.

Tolley, George, Donald Kenkel and Robert Fabian, eds. 1994. *Valuing Health for Policy: An Economic Approach*, Chicago: University of Chicago Press, 1994.

Tu, Jack V., Chris L. Pashos, C. David Naylor, Erluo Chen, Sharon-Lise Normand, Joseph P. Newhouse and Barbara J. McNeil. 1997. "Use of Cardiac Procedures and Outcomes in Elderly Patients with Myocardial Infarction in the United States and Canada." *New England Journal of Medicine*. May 22, 336:21, pp. 1500–1505.

Viscusi, W. Kip. 1993. "The Value of Risks to Life and Health." *Journal of Economic Literature*. December, 31:4, pp. 1912–1946.

Wang, Thomas J. and Randall S. Stafford. 1998. "National Patterns and Predictors of Beta-Blocker Use in Patients With Coronary Artery Disease." *Archives of Internal Medicine*. September 28, 158:17, pp. 1901–1906.

Winslow, Constance M. et al. 1988a. "The Appropriateness of Carotid Endarterectomy." *New England Journal of Medicine*. March 24, 318:12, pp. 721–27.

Winslow, Constance M. et al. 1988b. "The Appropriateness of Performing Coronary Artery Bypass Surgery." *Journal of the American Medical Association*. July 22–29, 260:4, pp. 505–10.